

Malaria Among Heroin Users

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OFFICIALS of the Ventura County Health Department notified the State of California Department of Public Health in December 1970 that during the preceding 4 weeks four cases of malaria had been diagnosed in residents of a small town in Ventura County. Of the four persons, one was known to be a veteran recently returned from Vietnam; the other three had never been outside the United States.

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The occurrence of these cases of malaria, along with another two cases detected, in a town of 500 persons that had never previously reported the disease was unusual. On January 5, 1971, a physician and a nurse epidemiologist from the State health department's bureau of communicable disease control joined the staff of the Ventura County Health Department to document this cluster of cases and to determine how the parasite was introduced and spread.

Materials and Methods

The diagnosis of *Plasmodium vivax* malaria in each of the six patients was confirmed by examination of blood smears at the Microbial Diseases Laboratory (MDL) of the State department of public health. Hospital records of all other cases of malaria reported in Ventura County residents during the preceding year were reviewed. Evidence suggesting the source of the disease and its connection with the current outbreak was collected.

Others Assisting in the Study

The following persons participated in the laboratory and field investigations of this outbreak of malaria and in the preparation of this report: James Chin, M.D., Ronald Roberto, M.D., Robert Magoffin, M.D., Miss Cathy Powers, Harvey Magy, and Mrs. Florence Morrison-Clark, of the State of California Department of Public Health; Stephen Coray, M.D., Mrs. Sherry Ensor, and Terry Gilday, of the Ventura County Health Department; Myron Schultz, M.D., D.V.M., Arthur S. Dover, M.D., and the Fluorescent Antibody Laboratory, Parasitic Serology Section, Center for Disease Control, Atlanta, Ga.

The patients and their families were questioned concerning possible sources of infection resulting from travel, blood transfusions, use of self-injected intravenous drugs, or persons with whom drugs had been shared. Known contacts and friends of the patients were sought and questioned. Peripheral blood samples were obtained from each malaria patient and his household family contacts for examination and de-

termination of indirect fluorescent antibody (IFA) titers.

Technicians at the MDL examined the blood smears. Serums were submitted to the Fluorescent Antibody Laboratory, Center for Disease Control, for determination of malaria antibody by the IFA technique.

The county's records for the past 50 years on surveillance of mosquitoes were reviewed. A team composed of investigators from the county and the State vector control bureaus inspected the town in December 1970 and January 1971 for *Anopheles* mosquitoes. The local health officer asked all physicians in the county to report any case of suspected malaria. The State issued a similar notice to all county health officers.

Results

Six cases of *P. vivax* malaria were ultimately identified, two in recently discharged veterans. G.S., a 25-year-old man who had returned from Vietnam 5 months before this episode, had sought treatment for a recurrent attack of *P. vivax* infection shortly after the other patients had been hospitalized (see chart). He had malaria 16 months before in Southeast Asia. D.G., 20 years old, had malaria in Vietnam. Since returning to this country 5 months before the outbreak, he gave a history of intermittent chills and fever for which he sporadically took quinine and dapson, which he had saved from Vietnam. During this time he did not seek medical attention although he was a contact of the other patients. Examination of his blood smear at the time of the investigation showed *P. vivax*. Both veterans, admitted users of heroin, shared their materials with the four civilian patients.

A.G. and R.M., 23 and 27 years old, are related to both veterans by family ties. J.A., a 35-year-old man with a large family, had steady employment as did four other patients. The response of alerted physicians uncovered the sixth case in S.V., a 21-year-old man who worked with three other patients.

All six patients had *P. vivax*, identified by microscopic observation of a stained blood smear, and all but one showed an antibody titer of 1:64 to *P. vivax* (see table). The blood samples were obtained in January 1971. Blood samples from 20 members of their immediate households and close friends were negative for malarial parasites in direct microscopic observation and IFA tests to *Plasmodium falciparum*, *P. vivax*, and *Plasmodium malariae*.

In the 12 months preceding this outbreak, five cases of malaria had been reported from Ventura County. All involved men recently returned from Southeast Asia, where they are believed to have acquired the disease. None of the men lived near the town having the outbreak or knew those involved in the outbreak.

The county's 50-year records on surveillance of mosquitoes

showed only occasional *Anopheles freeborni* in the area. This vector of malaria is the one most frequently identified in California. In several inspections of the town during winter, shortly after the outbreak, only one anopheline mosquito (species unknown) was observed.

Discussion

Malaria was introduced into California by settlers sometime after 1830 (1). During the last half of the 19th century, spreading of the disease by mosquitoes became a growing problem. Since the State department of public health assumed responsibility for mosquito control in 1915, there have been three periods of high incidence of the disease. Each period has corresponded with U.S. involvement in a major overseas conflict, most recently in Vietnam.

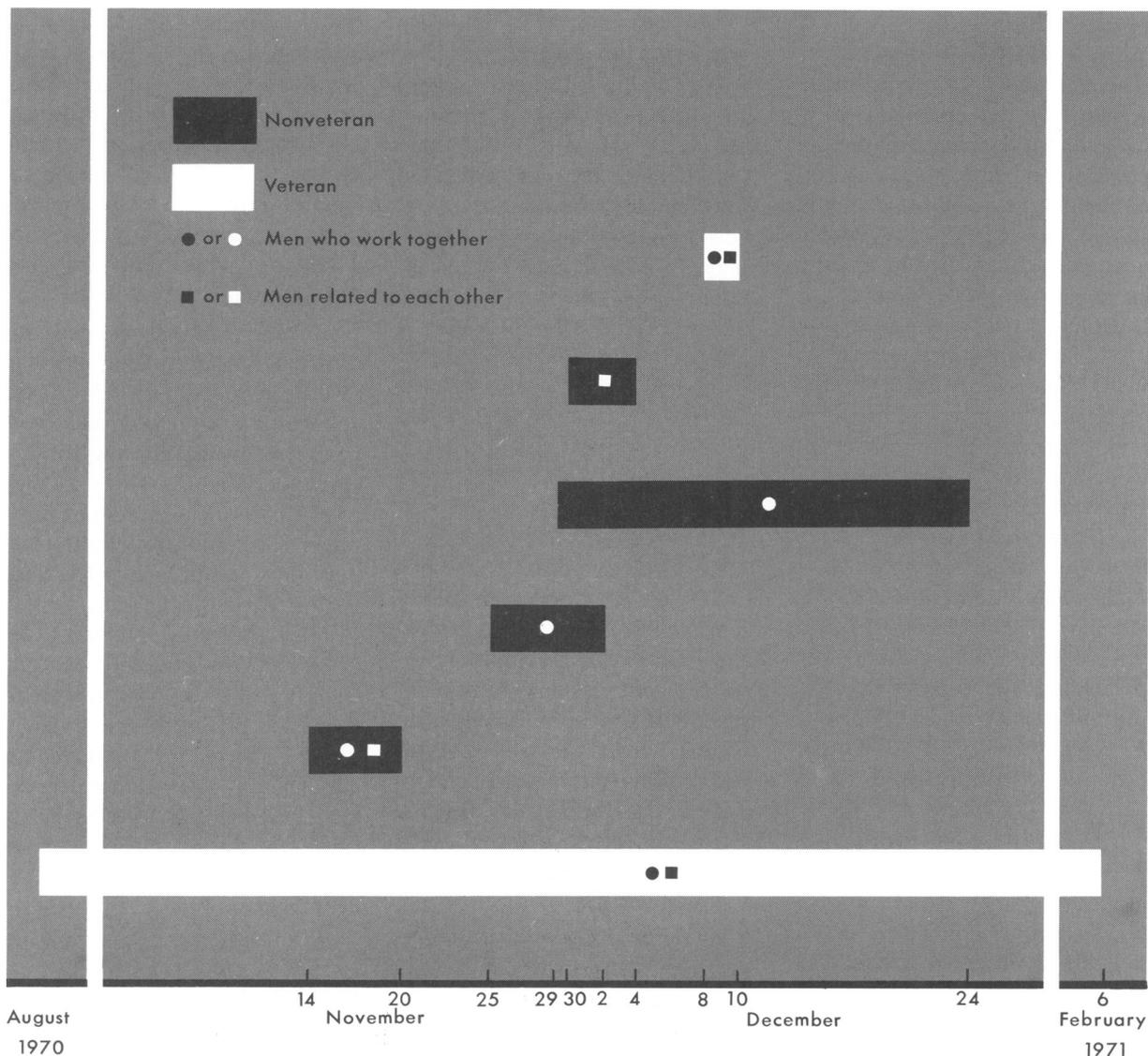
Importation of the disease by returning servicemen and foreign travelers has accounted for these peaks. The parasites have been largely confined to these groups, entering the community only occasionally through blood transfusions and isolated mosquito-borne outbreaks (2-6). Since 1954, indigenously acquired malaria has essentially been eliminated from California.

Antibody titers of six patients whose blood smears showed *Plasmodium vivax*, Ventura County, Calif., 1971

Patients	Age	Indirect fluorescent antibody titers ¹	
		<i>Plasmodium vivax</i>	<i>Plasmodium falciparum</i>
D. G. ²	20	1:64	(³)
A. G.....	23	1:64	(³)
J. A.....	35	1:64	1:16
R. M.....	27	1:64	1:16
S. V.....	21	(³)	(³)
G. S. ²	25	1:64	1:16

¹ All six were negative for *Plasmodium malariae*. ² Veteran recently returned from Vietnam. ³ Negative.

Temporal and family relationships of malaria patients, with onset and termination of symptoms, Ventura County, Calif., 1970-71



The spread of malaria through equipment that has been shared for intravenous drug use was first reported by Biggam in 1929 from Egypt (7). The problem was first reported in the United States from San Francisco in 1932 (8). It continued through the mid-1940's (9) but was largely confined to eastern cities, where the use of heroin was most prevalent and the introduction of malaria through persons working in and passing through the ports was not

common. Before the Vietnam conflict, this method of spread was last reported in the United States in 1950 (10).

The greatest danger from malaria to heroin users is the spread of *P. falciparum*. In 1938 in New York City, Most (9) reported 45 falciparum infections in addicts, nine of whom died. That the clinical manifestations of falciparum malaria in these addicts were not particularly suggestive of malaria is of note. Many of these patients

were diagnosed as having symptoms of drug withdrawal or of using adulterated drugs (11). In the 1970 outbreak the agent was *P. vivax*, a relatively benign and self-limited infection when induced by inoculation of infective blood (12). The symptoms in these patients, periodic chills and fever, were typical of malaria.

Treatment consisted of chloroquine phosphate only since the exo-erythrocytic phase of *P. vivax* is not encountered when the dis-

ease is transmitted by needle. The two veterans were also treated with primaquine, however, as they probably had mosquito-acquired infections that have the exo-erythrocytic phase of the parasite.

The Ventura investigation indicated that the cluster of malaria cases originated from one or both of the two veterans because both shared their equipment and had documented parasitemia. One became symptomatic and sought treatment 2 to 3 weeks after onset of clinical illness in the other patients. The other had a number of clinical recurrences in the 5-month period between his return from Vietnam and the onset of illness in the group.

The reported incidence of malaria in the United States is higher than at any time since the Korean conflict. During 1970 in this country 3,997 patients with parasitemia were reported (81.6 percent *P. vivax* and 12.5 percent *P. falciparum*); 3,872 (97 percent) were returnees from Southeast Asia (13).

Identification and treatment of persons having malarial infection after discharge from military service poses a problem that is difficult to solve. A recent U.S. Army study showed that 26 percent of 183 men tested, who recently returned from Southeast Asia without a history of clinical malaria, had indirect fluorescent antibodies to malarial parasites (14).

Spread of malaria by these men was documented by Fisher and Schultz (15) in 1969. They traced two transfusion-induced cases of malaria to veterans who denied being clinically ill 6 to 13 months after returning from Vietnam and who reportedly took their prescribed prophylactic medications. If this group was added to the veterans who have

a history of clinical malaria in Southeast Asia, then the total number of men who potentially could have relapses of malaria would increase markedly.

Use of heroin intravenously among U.S. troops in Vietnam is said to be great. In the United States there are an estimated 200,000 or more heroin users, mostly males under the age of 30 (16). In addition, the number of heroin users is believed to be growing. Thus, the potential is great for more cases of induced malaria through the use of narcotics in this country. This potential was realized again several months after the outbreak in Ventura, when a much larger outbreak of needle-associated malaria was observed in Bakersfield, Calif. (C. Friedmann and associates, of the health department and CDC, in an unpublished report concerning an outbreak of induced vivax malaria among intravenous heroin users in California). In this outbreak 47 cases of malaria associated with the use of heroin were detected. The index patient probably was a Vietnam veteran.

The presence of malaria that is associated with drug addicts will increase the risk of spreading this disease to the general public. The potential for transmission by mosquitoes may increase because most civilian addicts, contrasted with ex-servicemen, will not recognize that their symptoms are those of malaria. This factor, plus the fear of many addicts that they may not be able to get drugs if they are hospitalized, may increase the number of untreated parasitemic cases available for potential transmission by mosquitoes. Fortunately, the outbreak in Ventura occurred during the nonmosquito season and, consequently, the disease was not

spread by this route from the patients to their immediate household contacts.

Another increased threat to the public lies in potential spreading of the disease by blood transfusions. Blood bank technicians, who usually reject recent veterans as donors for fear of subclinical malaria, now have to suspect this disease among the growing population of young adults who use drugs intravenously.

Malaria presents an added dimension to the growing problem of drug abuse. Physicians should consider a diagnosis of malaria if young adults have fevers of unknown origin, especially if they admit to or are suspected of using drugs intravenously. Prompt reporting of such cases to the local health department is essential. Control measures, including the epidemiologic treatment of drug users, can be undertaken to limit spreading of the disease by continued sharing of intravenous equipment and by mosquito vectors. Vigilance is necessary to prevent malaria from being reestablished as an endemic disease in the United States.

REFERENCES

- (1) Gray, H. F., and Fontaine, R. E.: A history of malaria in California. In Proceedings and papers of the 25th Annual Conference of the California Mosquito Control Association, Inc., San Jose, Jan. 21-23, 1957. Abbey Press, Oakland, 1957.
- (2) Brunetti, R., et al.: An outbreak of malaria in California, 1952-1953. *Am J Trop Med Hyg* 3: 779-788 (1954).
- (3) Dunn, F. L., and Brody, J. A.: Malaria surveillance in the United States, 1956-1957. *Am J Trop Med Hyg* 8: 447-455 (1959).
- (4) Center for Disease Control: Malaria surveillance report:

- 1966 annual summary. Atlanta, Ga., 1967.
- (5) Center for Disease Control: Malaria surveillance report: 1967 annual summary, Atlanta, Ga., 1968.
- (6) Center for Disease Control: Malaria Surveillance report: 1968 annual summary. Atlanta, Ga., 1969.
- (7) Biggam, A. G.: Malignant malaria associated with the administration of heroin intravenously. *Trans R Soc Trop Med Hyg* 23: 147-153 (1929).
- (8) Geiger, J. C.: Malaria in narcotics addicts. *JAMA* 98: 1494, Apr. 30, 1932.
- (9) Most, H.: Malignant malaria among drug addicts. *Trans R Soc Trop Med Hyg* 34: 139-172 (1940).
- (10) Dover, A. S.: Malaria in a heroin user. *JAMA* 215: 1987, Mar. 22, 1971.
- (11) Schoenback, E. B., and Spingarn, C. L.: Inoculation malaria and drug addiction. *J Mount Sinai Hosp NY* 8: 998-1004 (1942).
- (12) Baker, F. T.: Induced malaria as a therapeutic agent. *In Malariology*, edited by M. F. Boyd. W. B. Saunders & Co., Philadelphia and London, 1949, p. 1149.
- (13) Center for Disease Control: Malaria surveillance report: 1970 annual summary. Atlanta, Ga., 1971.
- (14) Leibovitz, A., et al.: The prevalence of malarial fluorescent antibodies in Vietnam returnees with no history of overt malaria. *Milit Med* 134: 1344-1347 (1969).
- (15) Fisher, G. V., and Schultz, M. G.: Unusual host-parasite relationship in blood-donors responsible for transfusion-induced falciparum malaria. *Lancet* No. 7623: 716-718, Oct. 4, 1969.
- (16) Richards, L. G., and Carroll, E. E.: Illicit drug use and addiction in the United States. *Public Health Rep* 85: 1035-1041, November 1970.

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Four cases of *Plasmodium vivax* malaria in young male users of heroin in California were traced to drug sharing with two other patients, both veterans who had recently returned from Vietnam. Each veteran had malaria during the previous year. One had chronic untreated parasitemia at the time of the outbreak. Investigation failed to demonstrate spread of the disease from the veterans by any means other than shared intravenous drug administration equipment. Mosquitoes capable of transferring the parasite from person to person were present in the Ventura

County town but only in small numbers. None of the household contacts of the patients became infected.

All six patients had *P. vivax* identified by microscopic observation of a stained blood smear (obtained in January 1971), and all but one showed an antibody titer of 1:64 to *P. vivax*. Blood samples from 20 members of their immediate households and close friends were negative for malarial parasites in direct microscopic observation and IFA tests to *Plasmodium falciparum*, *P. vivax*, and *Plasmodium malariae*.